Instruction Manual

Thermo Scientific MicroModulyo®

Freeze Dryer

Part of Thermo Fisher Scientific

Thermo SCIENTIFIC

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1.0 DESCRIPTION

This manual provides installation, operation and maintenance instructions for the Thermo Scientific MicroModulyo Freeze Dryer. The MicroModulyo must be used as specified in this manual.

Read this manual before installing and operating MicroModulyo. Important safety information is highlighted as WARNING and CAUTION instructions; you must obey these instructions. The use of WARNINGS and CAUTIONS are defined below.

WARNING: Warnings are given where failure to observe the instruction could result in injury or death to people.

CAUTION: Cautions are given where failure to observe the instruction could result in damage to equipment, associated equipment and process.

In accordance with the recommendations of IEC1010, the following warning symbols may appear on the freeze dryer:

Caution - refer to accompanying documents

Caution - risk of electric shock

Caution - hot surface

1.1 THE MICROMODULYO

The MicroModulyo is the ice condenser section of a freeze drying system. It is a low cost unit suitable for freeze drying biological research materials and preparations in a laboratory. The MicroModulyo requires only the attachment of a pump and a drying accessory for samples to form a complete freeze drying system.

The MicroModulyo has a condenser chamber, a refrigeration system and a control system with temperature indicator. The refrigerant used in the MicroModulyo is CFC-free. All the MicroModulyo components are housed in a steel cabinet which is designed for bench top use. The components are described in the following sections. (See Figure 1 for location of components.)

When used with suitable accessories, the MicroModulyo can be used to freeze dry materials in bulk trays, round bottomed flasks, tubes, vials or ampules. Alternatively, the MicroModulyo can be used as a low temperature vapor trap (cold trap) that may be attached to an existing evaporation facility. A number of drying accessories are available from Thermo Savant; refer to Section 6 for a full listing.

1.2 THE CONDENSER CHAMBER

The condenser chamber can trap up to 1.5 liters of ice before it needs to be defrosted & cleaned. It contains a cooling coil which condenses and freezes water vapor to protect the vacuum pump. The temperature of the cooling coil under normal operating conditions with no load applied is approximately –50 ˚C.

A 229 mm diameter accessory flange (1), is at the top of the condenser chamber. All Modulyo drying accessories with small flange (approx. 215 mm) diameter are compatible. The large chamber top opening allows easy inspection, cleaning and defrosting of the condenser chamber and enables high vacuum pumping rates to be attained.

A valved drain pipe runs from the base of the condenser chamber to the drain outlet (3) on the front of the MicroModulyo. The drain valve on the front of the MicroModulyo (2) controls the operation of the valve in the drain pipe. The drain pipe is used to drain liquid condensate from the chamber and to admit air into the system.

A vacuum pipeline connects the chamber to a vacuum pump connector (4) on the front of the MicroModulyo. You can connect a vacuum pump to this connector to evacuate the condenser chamber and produce the high vacuum necessary for freeze drying.

1. Accessory flange
2. Drain valve
3. Drain outlet
4. Vacuum pump connector

Figure 1. The MicroModulyo Freeze Dryer

1.3 THE BAFFLE TUBE

A baffle tube is supplied with the MicroModulyo. The baffle tube is installed inside the condenser chamber to extend the vacuum pumping pipeline further into the condenser chamber. This results in an improved distribution of ice.

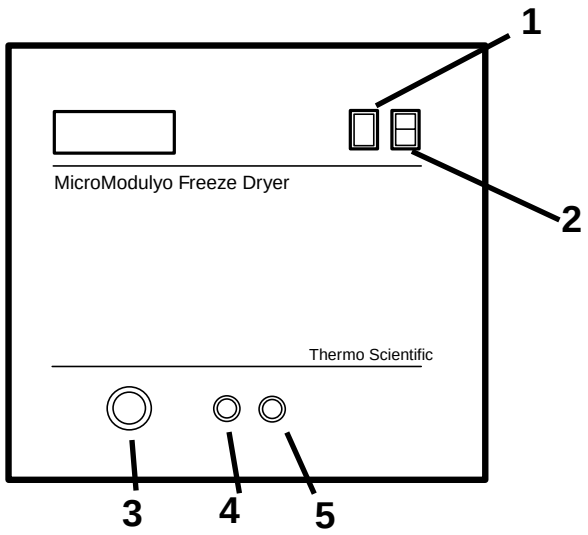
The baffle tube must be used when a load capacity of 1 liter or more will be collected, to ensure an open path for vapor flow within the condenser.

1.4 CONTROL PANEL AND CONNECTIONS

Refer to Figure 2. The controls and connection points of the MicroModulyo are all positioned on the front panel. Use of controls and connections is described in Table 1.

Control/connection	Use
On/off switch	This is a rocker-action switch (position "O"=off, position "I"=on).
Operating Temperature lamp	This green lamp goes on when the MicroModulyo has reached its operating temperature.
Drain valve	When closed, this valve isolates the condenser chamber from the drain-outlet. When open, this valve is used to admit air into the vacuum system and also to drain water from the condenser chamber after defrosting.
Drain outlet	This outlet is used to drain water from the MicroModulyo during defrosting of the condenser chamber and cooling coil. The outlet is also used to admit air into the vacuum system.
Vacuum pump connector	Use this to connect your vacuum pump to the MicroModulyo.

Table 1.- Controls and connections



1. Operating Temperature lamp
2. On/Off switch
3. Drain Valve
4. Drain outlet
5. Vacuum Pump Connector

Figure 2. Front Panel

1.5 PROTECTION DEVICES

The MicroModulyo is protected by a thermal magnetic circuit breaker which is integral to the on/off (refrigeration) switch. You must manually reset the switch when the circuit breaker trips.

The electrical supply to the MicroModulyo must be suitably fused (refer to Section 3.1).

1.6 APPLICATIONS

If you want to use the MicroModulyo as a freeze dryer, you must connect it to a two-stage vacuum pump and attach a drying accessory. When you use the MicroModulyo as part of a freeze drying system, we recommend that you keep accurate records of all operating parameters (sample load, drying times, and so forth). This data will help you to determine the optimum cycle for efficient operation with various products.

Some factors which affect the freeze drying process are described in the following sections.

1.7 THE FREEZING PROCESS

You must first pre-freeze the product prior to placing it on (or in) the drying accessory. The thickness of the ice (and hence the product) will affect the length of time needed to dry a given sample. In general, the thickness should be less than 10 mm. Rate of freezing can also affect drying times; slow freezing rates produce larger ice crystals hence a more porous “cake”, which dries more quickly.

1.8 THE DRYING PROCESS

When the condenser has reached its operating temperature (~-40 ˚C) the operating temperature lamp goes on and the vacuum pump can be switched on (see Sections 3.3 and 4.5). The pressure in the condenser chamber then starts to drop, producing the conditions necessary for freeze drying.

The time required to dry a given product is determined by a number of factors. These include type of product, mass and thickness, type of container, temperature of the product and condenser, rate of heat transfer into the product, pressure and system performance.

Freeze drying requires an input of heat energy to the product to change the ice into water vapor. When using the MicroModulyo, this energy may be absorbed solely from the surroundings or, alternatively, a heated accessory may be used to supplement this heat input. If you use a heated accessory, the accessory should not be switched on until the pressure in the condenser chamber has fallen to 1 mbar (0.76 Torr) or lower. An accessory vacuum gauge must be used to measure system pressure; see Section 6.2

When deciding on the quantity of heat input required, or when optimizing the drying cycle for a particular product, it is important to observe the physical appearance of the product whenever possible during the drying process. If the product has been correctly frozen, it will usually appear to be uniform in color and compact. If the product

1.8 THE DRYING PROCESS (cont'd)

is uneven in color, or if signs of melting and foaming are visible, then the product may have been incorrectly frozen or may have undergone some physical change, possibly from the application of too much heat. A wide range of factors has to be considered when trying to optimize the drying cycle for a given product. To assist in this optimization, we recommend that you take note of the rate of change of both temperature and pressure within the condenser chamber during the freeze drying process.

2.0 SPECIFICATIONS

Dimensions, H x W x D:	305 x 330 x 432 mm (12 x 13 x 17 in)
Accessory-flange diameter:	229 mm (9.0 in)
Weight:	27 kg (59.5 lb)
Enclosure rating (BS 5490):	IP 22
Ambient operating temperature range:	5 to 24 ˚C
Maximum ambient storage temperature:	50 ˚C
Condenser chamber	
Ice capacity in 12 hours:	1.0 kg (2.2 lb)
Maximum ice capacity:	1.5 kg (3.3 lb)
Operating temperature:	-50 ˚C
Instrumentation	
On/Off switch:	Rocker switch with thermal magnetic circuit breaker
Operating temperature lamp:	Remote sensing thermostat

2.1 REFRIGERATION SYSTEM

Refrigerant type:	ISCEON 69L (R403a)
Refrigerant change:	96 ± 3 g (3.4 oz)
Expansion device:	capillary tube

2.2 ELECTRICAL DATA

	MicroModulyo-230	MicroModulyo-115
Nominal electrical supply:	220/240V	110/120V
	1-phase	1-phase
Electrical supply frequency:	50Hz	60Hz
Protection		
Internal	Thermal magnetic circuit breaker,rated at	
	3 A	8 A
External	10 A fuse	10 A fuse

2.3 CONSTRUCTION MATERIALS

Item	**Material**
Cabinet:	Steel
Condenser chamber:	Stainless steel
Vacuum pipeline:	Stainless steel
Baffle tube:	Nylon

2.4 VACUUM PUMP REQUIREMENTS

For freeze drying, your vacuum pump must meet the following specifications:

Type of pump:	Two-stage, oil-sealed rotary pump
Ultimate pressure:	$<5 \times 10^{-2}$ mbar (3.8×10^{-2} Torr)
Pumping rate:	30 l/min or more
Recommended pump :	Thermo Scientific FDP-series high vacuum pump

Note: Your vacuum pump must have a gas ballast facility to prevent water build-up in the pump. FDP-series pumps include oil filter and gas ballast oil return kit, and are specifically configured for the freeze drying application.

2.5 LEGISLATIONS AND STANDARDS

The MicroModulyo has been designed in compliance with the following legislation and standards:

- CE Directives

3.0 INSTALLATION

WARNING: The MicroModulyo is heavy. Do not attempt to lift it without suitable lifting equipment, or someone to help you move it. Use proper lifting technique (lift with the knees, not the back) to avoid personal injury.

Unpack and inspect: Remove all packing materials and inspect the MicroModulyo. If damaged, notify your supplier and the carrier in writing within three days; state the item number of the MicroModulyo together with your order number and your supplier's invoice number. Retain all packing materials for inspection. Do not use the MicroModulyo if it is damaged.

Check that your package contains the items listed in Table 2 below. If any of these items is missing, notify your supplier in writing within three days.

Qty	Description	Check ✓
1	MicroModulyo	❒
1	Baffle tube	❒
Vacuum pump connection kit, which contains:		
1	Thin tubing	❒
1	Adapter fitting	❒
1	Vacuum hose	❒

Table 2. Checklist of components

If the MicroModulyo is not being used immediately, replace the protective covers. Store the MicroModulyo in a clean, dry area until ready for use.

3.0 INSTALLATION (cont'd)

Site Preparation: The MicroModulyo is designed for use on a laboratory benchtop. Locate the MicroModulyo in its required operating position, within convenient access to a suitable electrical supply. A MicroModulyo system may also be set up on a mobile cart, such as Thermo Scientific's CC120/DX Deluxe Convenience Cart.

We recommend that you leave an air gap of at least 8 inches between all four sides of the MicroModulyo and any wall or obstruction. If you do not leave a sufficient air gap, poor cooling may result in poor performance. When you locate the MicroModulyo, you should also consider ease of access for general use, as well as for maintenance and repair work, when the external cover may need to be removed.

3.1 CONNECT THE MICROMODULYO TO THE ELECTRICAL SUPPLY

WARNING: Ensure that the electrical installation of the MicroModulyo conforms with your local and national safety requirements. It must be connected to a suitably fused and protected electrical supply and a suitable earth (ground) point.

1. Make sure that the MicroModulyo is suitable for use with your electrical supply voltage and frequency.
2. The MicroModulyo115 is supplied with a ready-to-use 2 meter long, 3 core electrical cable. The MicroModulyo230 is supplied with the same type of cable, which should be connected to an appropriate power plug as shown in Table 3 below.
3. Provide a 10 Amp fuse at the electrical supply outlet to protect the MicroModulyo.

Core	Electrical supply connection
Brown	Live or Line 1
Blue	Neutral or Line 2
Green/Yellow	Earth (ground)

Table 3.- Electrical supply cable connections

3.2 CONNECT THE VACUUM PUMP

WARNING: If you intend to freeze dry products which contain sodium azide, make sure that your vacuum pump and pipeline are suitable for freeze drying these products. If they are not suitable, there is a severe risk of explosion.

CAUTION: You must use a two-stage vacuum pump with the MicroModulyo. If you do not, the pump will have a short working life.

Connect your vacuum pump to the vacuum pump connector on the front of the MicroModulyo (Figure 2, item 5). The connector is suitable for use with a 10 mm inside diameter pipeline.

We recommend the use of a Thermo Scientific high vacuum pump with the MicroModulyo. These pumps are suitable for freeze drying products which contain sodium azides.

If you do not use a Thermo Scientific pump, the pump must meet the requirements specified in Section 2.4. To connect another type of pump to the MicroModulyo, refer to the instruction manual supplied with the pump.

3.3 CONNECT A THERMO SCIENTIFIC HIGH VACUUM PUMP TO THE MICROMODULYO

To connect a high vacuum pump to the MicroModulyo, refer to Figure 3 and use the following procedure.

1. Remove the vacuum pump connection kit from its packing material. As shown in Table 2 and in Figure 3, the kit contains a short segment of thin tubing (2), adapter fitting (3), and long length of vacuum hose (4).

2. Refer to Figure 3. Fit the centering ring and inlet filter assembly (6) to the inlet port of the pump, then use the clamp (7) to secure the nozzle connector (5) to the inlet port. (These items are included with the pump.)

3. Push the vacuum hose (4) onto the nozzle connector (5).

4. Push the short segment of thin tubing (2) onto the vacuum pump connector marked "VAC" (1) on the front panel of the MicroModulyo.

CAUTION: To ensure a leak-free system, it may be necessary to install suitable hose clamps at the nozzle and “VAC” connectors.

1. Vacuum pump connector “VAC”
2. Thin tubing
3. Adapter Fitting
4. Vacuum hose
5. Nozzle connector*
6. Centering ring and inlet filter assembly*
7. Clamp*
8. Thermo Scientific Pump

*Supplied with Thermo Scientific pump

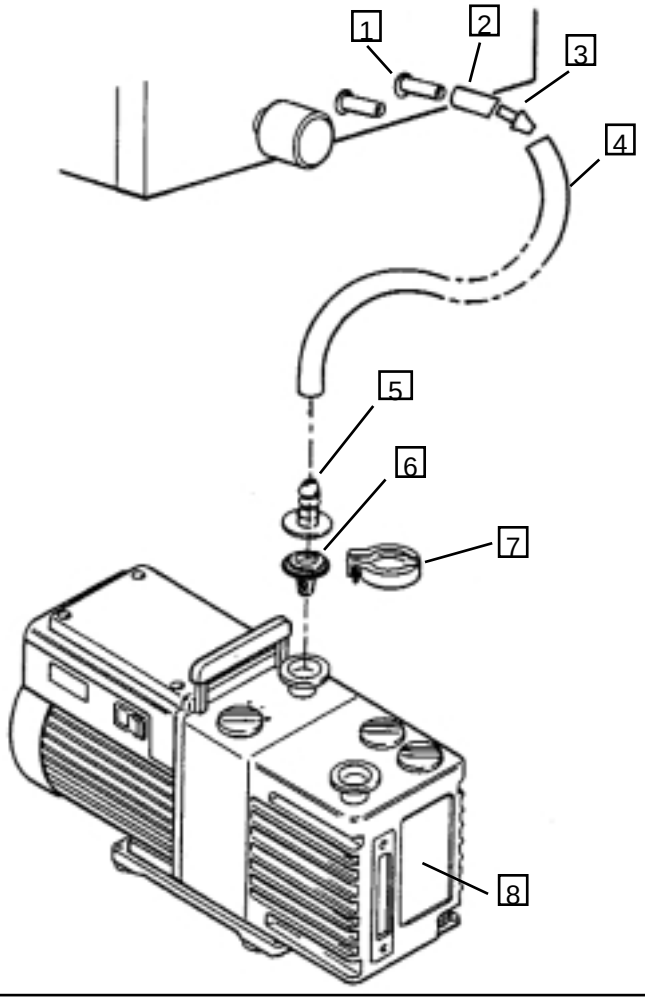


Figure 3. Connect a Thermo Scientific high vacuum pump to the MicroModulyo

3.4 PUMP OUTLET SAFETY

Fit an oil mist filter, or pipe the exhaust gases of the vacuum pump to a suitable chemical fume hood.

All Thermo Scientific FDP high vacuum pumps are supplied with a gas ballast oil return kit (GBORK) and EMF10 oil mist filter. Refer to specific manuals received with your pump

3.5 TEST AFTER INSTALLATION

CAUTION: Do not attempt to use the MicroModulyo if it fails the installation test. If you do, poor performance may result in the loss of the product being freeze dried.

When you have installed the MicroModulyo, use the following procedure to test that it works correctly.

1. Turn the unit ON.

2. Watch the cooling fan through the grill on the side of the MicroModulyo. If the fan rotates, then it is operating correctly: continue at Step 3. If the fan does not rotate, continue at Step 5 below.

3. Check that the compressor operates. If it operates, you will hear a low hum: continue at Step 4. If you cannot hear the compressor, continue at Step 5 below.

4. Leave the MicroModulyo on for approximately 30 minutes, then check that the operating temperature lamp is on. If the lamp is on, the MicroModulyo is ready for use. If the lamp is not on, continue at Step 5.

5. If any of the above steps fail, switch the MicroModulyo off, disconnect from electrical supply and contact Thermo Scientific or your distributor.

4.0 OPERATION

WARNING: If you intend to freeze dry products which contain sodium azide, make sure that your vacuum pump and pipeline are suitable for freeze drying these products. If they are not suitable, there is a severe risk of explosion.

Sodium azide is sometimes used as a stabilizing agent in freeze drying processes. Sodium azide is toxic and, when dry, is highly explosive.

If you freeze dry a product which contains sodium azide, a chemical reaction can occur in the presence of heavy metals such as copper, lead, zinc and cadmium. The result of this reaction is the formation of metallic azides which are highly unstable and explosive.

The MicroModulyo contains no heavy metals and is suitable for freeze drying products which contain sodium azide. The Thermo Scientific high vacuum pumps are also suitable for this purpose.

However, if you do not use a Thermo Scientific pump, your vacuum pump and vacuum pipeline may not be suitable for freeze drying products containing sodium azide. Check with your vacuum pump manufacturer to determine its suitability if you intend to freeze dry products containing sodium azide.

4.1 SEQUENCE OF OPERATION

Operation of the MicroModulyo can involve a number of different steps, as shown in Table 4 below.

Operation step	Refer to Section
Prepare the MicroModulyo	4.2
Fit the product container and any other necessary accessory	4.3
Pre-cool the MicroModulyo	4.4
Dry the product	4.5
Shut down	4.6

Table 4. Sequence of operation

Before freeze drying a product, always prepare the MicroModulyo as described in Section 4.2. Always dry the product and shut down the MicroModulyo as described in Sections 4.5 and 4.6

However, the order in which the remaining steps are carried out depends on the type of product container or other accessory used, and on the type of product to be freeze dried. In some circumstances you will need to pre-cool the MicroModulyo with the accessory flange open to atmosphere; in other circumstances, fit the product container, then pre-cool the MicroModulyo and then load the product to be freeze dried.

If the correct sequence of operations to follow is not clear, refer to the instruction manual supplied with the product container or other accessory you will use.

4.2 PREPARE THE MICROMODULYO

Note: Use only mild detergents to clean the condenser chamber, accessories and connecting pipeline. Some of the Thermo Scientific accessories are made from acrylic materials and must not be cleaned with organic solvents.

Before you first use the MicroModulyo, and between freeze drying cycles, prepare the MicroModulyo as follows:

1. Turn the drain valve fully counterclockwise to open the valve and to remove any water left in the bottom of the condenser chamber. When the chamber is completely drained, turn the drain valve fully clockwise to close it.

2. If acidic corrosive products have been processed, flush through the condenser chamber and drain line with clean water.

3. Make sure that the condenser chamber is dry.

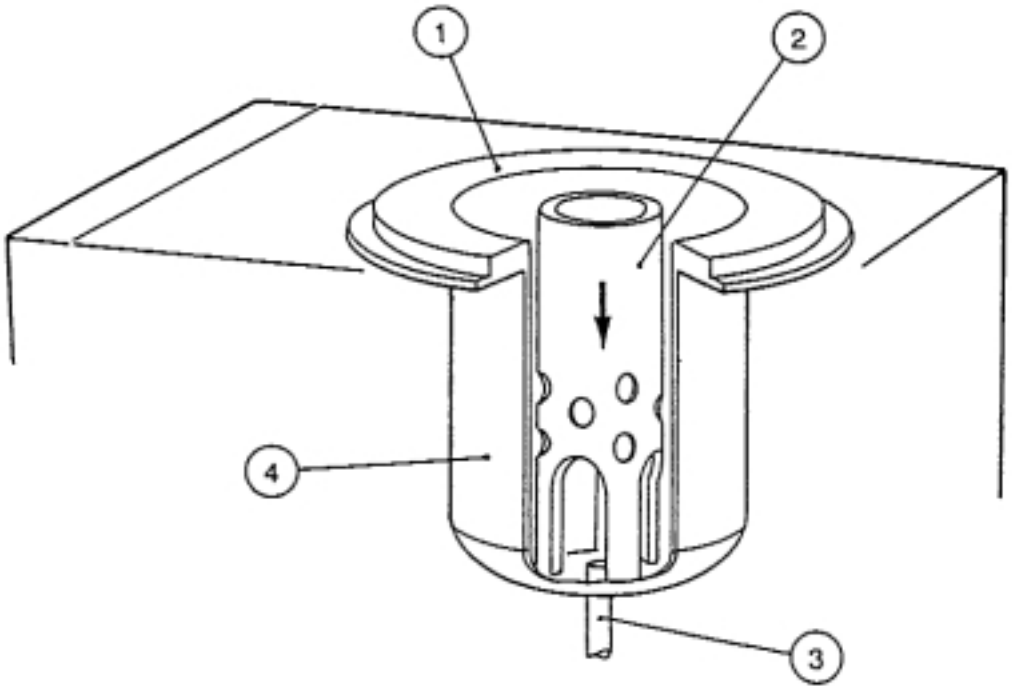
4. Make sure that the MicroModulyo is clean, particularly the accessory flange. If the flange is not clean, you will not get a good vacuum seal and the performance of the MicroModulyo will be poor.

5. Check the vacuum connection on the front of the MicroModulyo. Check the connection at the vacuum pump.

6. Refer to Figure 4. Install the baffle tube by placing it over the drain outlet in the center of the condenser chamber. The cut-outs in the tube must be at the bottom. If you do not fit the baffle tube, the vacuum pump connection may become blocked with ice; this may cause a loss of vacuum and the product may melt. Use of the baffle tube is required especially when more then 1 liter of ice is processed.

7. Select a suitable drying accessory for the product. Wipe clean the sealing ring of the accessory and check the sealing ring for damage; if it is damaged, fit a new sealing ring. The accessory sealing ring should not need lubricating, but if it is excessively dry, apply a light wipe of high vacuum grease.

4.2 PREPARE THE MICROMODULYO (cont'd)



1. Accessory flange
2. Baffle tube
3. Drain outlet
4. Condenser chamber

Figure 4. Fit the baffle tube for distribution of ice

4.3 FIT THE PRODUCT CONTAINER AND OTHER ACCESSORIES

A drying accessory may be connected to the MicroModulyo accessory flange. Accessories have a rubber sealing ring to seal the accessory to the flange. Once positioned, the weight of the accessory is sufficient to produce an airtight seal under vacuum conditions. The accessory flange has a diameter of 229 mm, which is compatible with all the small-diameter accessories in the Modulyo product range.

4.4 PRE-COOL THE MICROMODULYO

WARNING: Do not touch any part of the condenser chamber during or immediately after the cooling process. The condenser chamber is at very low temperature and can cause tissue damage.

Pre-cool the MicroModulyo condenser chamber as follows:

1. Switch the MicroModulyo "ON".

2. Leave the MicroModulyo on until the operating temperature lamp goes on.

3. Wait 5 minutes longer before operating.

4.5 DRYING

CAUTION: Use gas ballast on the vacuum pump when drying. If you do not, water may condense in the pump.

1. On Thermo Scientific vacuum pumps, install the Gas Ballast Oil Return Kit (GBORK), referring to its instructions. On other manufacturer’s pumps, fully open the gas ballast valve; refer to the pump instruction manual.

2. Switch the pump "ON".

   Take note of the following when freeze drying products:

   - Only switch on a heated accessory when the pressure is 1 mbar or less.
   - When a load is first applied to the MicroModulyo, the operating temperature lamp may go off for a few minutes. This is because the evaporation rate from the product is initially high.

     If the lamp does not go on again within a few minutes, the MicroModulyo is overloaded. Reduce the amount of product in the freeze drying system to prevent the product from melting. If using the MicroModulyo as a vapor trap, for a different process, restrict the flow of vapor from the connected apparatus to correct the overload.
   - If you wish to dry a number of flasks, first attach one flask, then evacuate the flask. If the operating temperature lamp goes off, wait until it is on again, then attach and evacuate the remaining flasks in the same way. This allows temperature and vacuum levels to recover between each flask.

4.5 DRYING (cont'd)

If you use this procedure, you can identify any flasks that leak. This procedure also prevents rapid pressure increases, which might cause flasks to fall off the drying accessory.

- If there appears to be a leak, check that the drain valve is fully closed and that all seals are clean. If the MicroModulyo continues to leak, contact Thermo Scientific or your distributor.

4.6 SHUTDOWN

CAUTION: If you use a manifold assembly, do not admit air into the MicroModulyo through the drain valve until all flasks have been removed, otherwise the flasks may fall off the manifold valves.

Look at the appearance of the product and consult data gathered from previous freeze drying operations to determine when the freeze drying process has finished.

Once the process has finished, shut down the MicroModulyo as follows:

1. If you use a manifold accessory, use the manifold valves to vent each flask in turn. Remove and seal each flask to protect the dried contents from atmospheric moisture.
2. Switch the vacuum pump OFF.
3. If you use other accessories, slowly open the drain valve to admit air to the system.
4. Remove the product when the system has reached atmospheric pressure.
5. Switch OFF the MicroModulyo.
6. Remove the drying accessory.

4.7 DEFROST THE MICROMODULYO

WARNING: Do not touch any part of the condenser chamber during or immediately after the cooling process. The condenser chamber is a very low temperature and can cause tissue damage.

WARNING: Do not pour water at a temperature greater than 50 ˚C into the ice condenser when it is cold. This may result in a dangerous rise in pressure in the refrigeration system.

Leave the MicroModulyo switched off at ambient temperature to defrost it. Make sure that all water is drained from the condenser chamber before you switch the MicroModulyo on again. This method takes up to five hours to complete, depending on ambient temperature.

4.7 DEFROST THE MICROMODULYO (cont'd)

Alternatively, you can pour warm water into the ice condenser to speed up the defrosting process. This method is useful if you wish to use the MicroModulyo again immediately.

Use the following procedure:

1. Remove the drying accessory from the accessory flange.
2. Close the drain valve.
3. Pour warm water, at a maximum temperature of 50 ˚C, into the condenser chamber. Do not fill the chamber above the level of the vacuum pipeline (aperture near top of chamber wall).
4. Wait for a few minutes to allow the ice to melt.
5. Fully open the drain valve and allow the water to drain from the condenser chamber. A piece of tubing can be connected to the drain outlet for easier drainage into a sink or a container.
6. Remove the baffle tube. Clean and dry both the baffle tube and the inside of the condenser chamber.

Prepare the MicroModulyo for the next operational cycle as described in Section 4.2.

4.8 OPERATING WITH NO LOAD

If you operate the MicroModulyo with no load for several hours, the internal components get very cold. Atmospheric water vapor will then condense onto the cold surfaces and may drip out of the bottom of the MicroModulyo. You may therefore see puddles of water under the MicroModulyo, which gives the impression that water is leaking from the condenser chamber.

If you see water dripping out of the MicroModulyo, inspect the condenser chamber. If there is ice in the chamber, the water is probably not leaking from the chamber, but is dripping from the cold surfaces inside the MicroModulyo. Always check this carefully before you contact the manufacturer or your distributor for advice.

To avoid this problem, we recommend that you shutdown the MicroModulyo if not using it for more than three or four hours. This is particularly important if you use the unit in a high-humidity environment.

5.0 MAINTENANCE

Note: You must obey the maintenance procedures defined in the instruction manuals supplied with your accessories and vacuum pump.

5.1 SAFETY

WARNING: Obey the safety instruction given below and take note of appropriate precautions. If you do not, you can cause injury to people and damage to equipment.

5.2 PRECAUTIONS

- Switch off the MicroModulyo, isolate it from the electrical supply and defrost it before you start maintenance.

- Do not touch any part of the condenser chamber during or immediately after the cooling process. The condenser chamber is at a very low temperature and can cause tissue damage.

- Do not pour water at a temperature greater than 50 ˚C into the condenser chamber when it is cold. If you do, this may result in a dangerous pressure rise in the refrigeration system.

- Ensure that you do fault finding in a well-ventilated area.

- After you have rectified a fault, ensure that the electrical installation of the MicroModulyo conforms with your local and national safety requirements. It must be connected to a suitably fused and protected electrical supply and a suitable earth (ground) point.

5.3 REFRIGERANT LEAKS

The refrigerant used in the MicroModulyo is heavier than air and is an asphyxiant by the displacement of oxygen. If a refrigerant leak is suspected, place the unit in a well-ventilated area. Do not allow naked flames or smoking near the MicroModulyo, as products of combustion of the refrigerant include dangerous fluorides and chlorides.

If refrigerant vapor is inhaled, summon medical help immediately. Take the victim to a well-ventilated, uncontaminated area. If the victim's breathing is weak or has stopped, apply artificial ventilation, preferably using an oxygen resuscitator. Do not use adrenaline or other cardiac stimulants.

At normal atmospheric pressure, the refrigerant will evaporate at –40 ˚C. Contact with skin or eyes can cause cold burns. If contact has taken place, seek medical help immediately and carry out the following: Remove clothing from the affected area; carefully irrigate the affected area with tepid water for at least 15 minutes; apply a sterile dressing and treat the wound as you would a heat burn.

6.0 ACCESSORIES

Accessory	Item number
8-port Column manifold	F05656000
Bell jar	F02960000
Work table	F02305065
Vial Cell stoppering shelf	F05623000
Heater kit for stoppering shelf (230 V 50 Hz)	F05655000
Heater kit for stoppering shelf (115 V 60 Hz)	F05655115
Spin Freezer 96 (230 V 50 Hz)	F05637000
Spin Freezer 96 (115 V 60 Hz)	F05637115
Secondary drying manifold, single column	F02964000
Secondary drying manifold, additional column	F02956000
Secondary drying manifold, double column	F02965000
Cold trap adapter (NW40 connections)	F05660000
Pipeline attachment	F02305082
Adapter flange	F05626000
Isolation valve	F05643000

6.1 GLASSWARE AND CONNECTIONS

Accessory	Item number
Wide-mouth flasks and accessories	
1000 ml	F05657000
500 ml	F05650000
300 ml	F05658000
Flask lid (includes adapter)	F05659000
Flask lid filters, 100/pk	F05659222
Cone connector kit (to attach other vessels)	F05651000
Replacement O-rings for Flask lid, 25/pk	H02125020-B
Vials and sealing accessories	
2 ml vial, 288/pk	H01430008
5 ml vial, 288/pk	H01430048
10 ml vial, 100/pk	H01430042
Stopper, 13 mm, for 2 ml vials, 1000/pk	H01430121
Stopper, 20 mm, for 5 and 10 ml vials, 1000/pk	H01430122-B
Aluminum seal, 13 mm, for 2 ml vials, 1000/pk	H01430161
Aluminum seal, 20 mm, for 5 and 10 ml vials, 1000/pk	H01430162
Crimper, 13 mm, for 2 ml vials	H01430203
Crimper, 20 mm, for 5 and 10 ml vials	H01430204

6.2 CONVENIENCE ACCESSORIES

Install the MicroModulyo on a convenience cart for easy mobility. Add a vacuum gauge between condenser and pump to monitor system conditions during a run.

Accessory	Item number
Convenience cart	CC120/DX
Digital vacuum gauge (50 Torr–10 millitorr)	DVG50-115 (115 V 60 Hz) DVG50-230 (230 V 50 Hz)

6.3 VACUUM PUMP AND ACCESSORIES

Thermo Scientific high vacuum pumps are suitable for use with the MicroModulyo. These pumps are also suitable for freeze drying products which contain sodium azide. Vacuum pump accessories are also available. Please contact customer services or your supplier to discuss your vacuum pump requirements.

FDP-series vacuum pumps are pre-configured with accessories for freeze drying. They include EMF10 oil mist filter, GBORK gas ballast oil return kit, and DDA110DK stainless steel drain kit. The LyoPump™ is an FDP200 pump coupled with VPOF110 vacuum pump oil filter/recirculator. The filter unit continuously draws oil from the pump, filters it to remove acid and particulates, and returns it to the pump, thus keeping the oil cleaner and extending the interval between pump maintenance.

Accessory	**Item number**
76 l/min vacuum pump (115V 60 Hz) with accessories	FDP80-115
62 l/min vacuum pump (230V 50 Hz) with accessories	FDP80-230
116 l/min vacuum pump (115V 60 Hz) with accessories	FDP120-115
97 l/min vacuum pump (230V 50 Hz) with accessories	FDP120-230
195 l/min vacuum pump (115V 60 Hz) with accessories	FDP200-115
162 l/min vacuum pump (230V 50 Hz) with accessories	FDP200-230
LyoPump™ (115 V 60 Hz), FDP200-115 + VPOF110-115	VLP195FD-115
LyoPump™ (230 V 50 Hz), FDP200-230 + VPOF110-230	VLP195FD-230

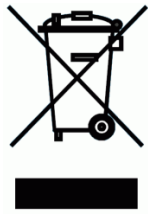
WEEE Compliance

WEEE Compliance. This product is required to comply with the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive 2002/96EC. It is marked with the following symbol. Thermo Fisher Scientific has contracted with one or more recycling/disposal companies in each EU Member State, and this product should be disposed of or recycled through them. Further information on our compliance with these Directives, the recyclers in your country, and information on Thermo Scientific products which may assist the detection of substances subject to the RoHS Directive are available at **www.thermo.com/**

Great Britain

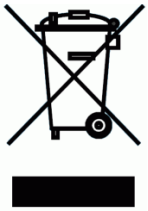
WEEE Konformittät. Dieses Produkt muss die EU Waste Electrical & Electronic Equipment (WEEE) Richtlinie 2002/96EC erfüllen. Das Produkt ist durch folgendes Symbol gekennzeichnet. Thermo Fisher Scientific hat Vereinbarungen getroffen mit Verwertungs-/Entsorgungsanlagen in allen EU-Mitgliederstaaten und dieses Produkt muss durch diese Firmen widerverwetet oder entsorgt werden. Mehr Informationen über die Einhaltung dieser Anweisungen durch Thermo Scientific, dieVerwerter und Hinweise die Ihnen nützlich sein können, die Thermo Fisher Scientific Produkte zu identizfizieren, die unter diese RoHS. Anweisungfallen, finden Sie unter **www.thermo.com/**

Deutschland



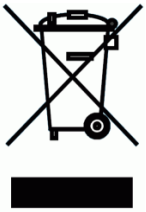
Conformità WEEE. Questo prodotto deve rispondere alla direttiva dell' Unione Europea 2002/96EC in merito ai Rifiuti degli Apparecchi Elettrici ed Elettronici (WEEE). È marcato col seguente simbolo.Thermo Fischer Scientific ha stipulato contratti con una o diverse società di riciclaggio/smaltimento in ognuno degli Stati Membri Europei. Questo prodotto verrà smaltito o riciclato tramite queste medesime. Ulteriori informazioni sulla conformità di Thermo Fisher Scientific con queste Direttive, l'elenco delle ditte di riciclaggio nel Vostro paese e informazioni sui prodotti Thermo Scientific che possono essere utili alla rilevazione di sostanze soggette alla Direttiva RoHS sono disponibili sul sito **www.thermo.com**/

Italia



Conformité WEEE. Ce produit doit être conforme à la directive euro-péenne (2002/96EC) des Déchets d'Equipements Electriques et Electroniques (DEEE). Il est marqué par le symbole suivant. Thermo Fisher Scientific s'est associé avec une ou plusieurs compagnies de recyclage dans chaque état membre de l'union européenne et ce produit devraitêtre collecté ou recyclé par celles-ci. Davantage d'informations sur laconformité de Thermo Fisher Scientific à ces directives, les recycleurs dans votre pays et les informations sur les produits Thermo Fisher Scientific qui peuvent aider le détection des substances sujettes à la directive RoHS sont disponibles sur www.thermo.com/

France



Important

For your future reference and when contacting the factory, please have the following information readily available:

Model Number: _____

Serial Number: _____

Date Purchased: _____

The above information can be found on the dataplate attached to the equipment. If available, please provide the date purchased, the source of purchase (manufacturer or specific agent/rep organization), and purchase order number.

IF YOU NEED ASSISTANCE:

SALES DIVISION

Phone: 1-866-984-3766 (866-9-THERMO)

LABORATORY PARTS and SERVICE

Phone: 1-800-438-4851

TECHNICAL SUPPORT

Phone: 1-800-438-4851

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